

(B) ~~wherein~~ said first region has a straight partial cylindrical shape, and said second region has a curved partial spherical shape and is provided at an end of said first region--

#### REMARKS

Favorable reconsideration and withdrawal of the rejections set forth in the above-mentioned Official Action in view of the foregoing amendments and the following remarks are respectfully requested.

Initially, it is noted that in the Official Action dated May 8, 2002, the Examiner set forth a two-way restriction requirement under 35 U.S.C. § 121, as follows:

I. Claims 1 through 22 and 37 through 39, said to be drawn to an optical connector, classified in Claim 35, subclass 129.

II. Claims 23 through 36 and 40, said to be drawn to fabrication of a waveguide for an optical connector, classified in Class 29.

A Response to the Restriction Requirement (the "Response") was filed June 6, 2002, wherein Applicants provisionally elected, with traverse, to prosecute the invention of Group I, namely Claims 1 through 22 and 37 through 39.

In the above-mentioned Official Action, Claims 1 through 22 and 37 through 39 have been acted on their merits and Claims 23 through 36 and 40 have been withdrawn from consideration. However, the Examiner has not commented on the traversal of the restriction requirement set forth in the Response. Accordingly, there is no indication(i) that the traversal of the restriction requirement has been considered and (ii)

whether the restriction requirement has been made final. Accordingly, the Official record is not clear regarding the status of the restriction requirement and the claims.

In view of the foregoing, the Examiner is respectfully requested to acknowledge the timely traversal of the Restriction Requirement set forth in the Response; indicate whether the Restriction Requirement has, in fact, been made final; and clarify the status of the claims in the next Official Action.

For purposes of this Amendment, Claims 23 through 36 and 40 have been treated as though they have, in fact, been withdrawn from consideration by the Examiner as being directed to a nonelected invention subject to a final restriction requirement.

Claims 1 through 37 and 39 through 41 are now pending in the application. Claim 38 has been canceled. As above-noted, Claims 23 through 36 and 40 have been withdrawn from consideration by the Examiner as being directed to a nonelected invention. Claims 1 through 6, 11 through 14, 16 through 22, 37, 39, and 40 have been amended to even more succinctly define the invention and/or to improve their form. Claim 41 has been added to accord Applicants an additional scope of protection commensurate with the disclosure. It is respectfully submitted that no new matter has been added. Claims 1, 12, 37, 39, and 41 are the only independent claims present in the application, which are discussed hereinbelow.

Claims 1 through 7, 12, 13, and 37 through 39 are rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 5,544,268 (Bischel, et al. '268).

Claims 8 through 10 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Bischel, et al. '268.

Claim 11 is rejected under 35 U.S.C. § 103(a) as being unpatentable over Bischel, et al. '268 in view of U.S. Patent No. 6,208,791 (Bischel '791).

Claims 14, 15, and 19 through 22 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Bischel, et al. '268 in view of U.S. Patent No. 6,125,217 (Paniccia, et al.).

Claims 16 through 18 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Bischel, et al. '268 in view of U.S. Patent No. 5,416,861 (Koh, et al.).

The rationale underlying each of the foregoing rejections is succinctly set forth in the Official Action. The rejections are respectfully traversed.

Amended, independent Claim 1 calls for an optical waveguide that includes a partial cylindrical portion. The partial cylindrical portion includes an elongated profile, and is formed of a material transparent to a light propagating along the partial cylindrical portion. A plurality of end portions, each of the plurality of end portions include an approximately partial spherical portion smoothly joining the partial cylindrical portion, and is formed of a same material as a material of the partial cylindrical portion. The light propagates along the partial cylindrical portion and the plurality of end portions and totally reflects the light at a boundary surface contouring the partial cylindrical portion and the plurality of end portions.

Amended, independent Claim 12 calls for a waveguide as defined in amended Claim 1 and further includes a substrate with at least one a light emitting device and a light receiving device disposed on the substrate. The plurality of end portions of the waveguide is positioned at a portion of the substrate corresponding to a position at which one of the light emitting device and the light receiving device is disposed.

The invention recited in each of independent Claims 1 and 12 features an optical waveguide, which includes a partial cylindrical portion and a partial spherical portion provided at its end. A sectional surface of the claimed optical waveguide has a curved surface.

Amended, independent Claim 37 calls for an optical waveguide that includes a first region having a straight partial spherical shape and a second region having a curved partial spherical shape. The second region is provided at an end of the first region.

Amended, independent Claim 39 calls for an optical interconnection device that includes a light emitting device, a light receiving device, and an optical waveguide for optically connecting the light emitting device and the light receiving device. The optical waveguide includes a first region including a straight, partial spherical shape, and a second region includes a curved, partial spherical shape. The second region is provided at an end of the first region.

The invention recited in amended, independent Claims 37 and 39 call for an optical waveguide, which includes an end region having a partial spherical portion.

Because the end of the claimed waveguide in each of Claims 1, 12, 37, and 39 includes a partial spherical portion provided at its end, the waveguide is easily connected with an optical device.

The Examiner asserts, at page 2 of the Official Action, that Bischel et al. '268 discloses “a waveguide (528) having a partial cylindrical portion.” As set forth in the SUMMARY OF THE INVENTION at page 4 of the specification, the term “partial

cylindrical portion” is defined as “a three-dimensional shape which is formed by cutting a cylinder with a plane parallel to its central axis.”

Bischel et al. '268 is understood to disclose conventional waveguides that have cross-sections, which are either square or trapezoidal, and which are similar to the conventional waveguides, such as those discussed in the BACKGROUND OF THE INVENTION set forth at page 3 of the specification.

Bischel, et al. '268 does not disclose a waveguide having either a partial cylindrical portion or a partial spherical portion. Rather, the shape of the sectional surface of the waveguide is oblong, as can be seen in Fig. 17.

It is respectfully submitted that Bischel, et al. '268 does not disclose an expressly claimed feature and does not anticipate the claimed invention. Accordingly, the Section 102 based on Bischel, et al. '268 rejection must be withdrawn.

Bischel, et al. '791, Paniccia, et al., and Koh, et al. are cited for allegedly disclosing other salient features of the invention recited in dependent claims. It is respectfully submitted that these citations do not remedy the above-noted deficiencies of Bischel, et al. '268 *via-à-vis* the claimed invention.

It is also respectfully submitted that the combination rejections are not well founded. The Examiner has provided a *rationalization* for combining the teachings of the cited art based on the benefits of doing so. A combination rejection is proper only when there is some suggestion or motivation in the cited art *per se* to cause one having ordinary skill in the art to combine the teachings of the cited art. There is nothing in the cited art which supports the position that it can be combined in the manner suggested. Even if the art could be so combined, the mere fact that the art can be combined is not sufficient if

there is no suggestions in the art that such a combination is desirable. For example, see ACS Hospital Systems, Inc. v. Montefiore Hospital, 221 U.S.P.Q. 929, 933 (Fed. Cir. 1984).

Newly-presented, independent Claim 41 calls for an optical device that includes an optical device and an optical waveguide which optically connects to the optical device. The optical waveguide includes a first region and a second region. The first region includes a straight partial cylindrical shape, and the second region includes a curved partial spherical shape and is provided at an end of the first region.

Claim 41 also features an optical waveguide including a partial spherical shape at its end.

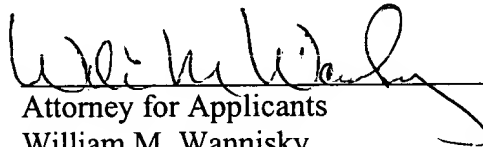
In view of the foregoing, it is respectfully submitted that independent Claims 1, 12, 37, and 39 through 41 are allowable over the cited art whether taken individually or in combination.

Claims 2 through 11, 13 through 22 depend either directly or indirectly from any one of Claims 1 and 22 and are allowable by virtue of their dependency and in their own right for further defining Applicants' invention. Individual consideration of the dependent claims is respectfully requested.

It is respectfully submitted that the claims on file are allowable over the art of record and that the application is in condition for allowance. Favorable reconsideration and early passage to issue of the present application are respectfully submitted.

Applicants' undersigned attorney may be reached in our Washington, D.C. office by telephone at (202) 530-1010. All correspondence should continue to be directed to our New York office at the address shown below.

Respectfully submitted,



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**VERSION WITH MARKINGS SHOWING CHANGES MADE TO  
SPECIFICATION**

The paragraph starting at page 1, line 21 through page 2, line 5 has been amended, as follows.

--As a light emitting device for performing optical transmission through the waveguide, there has been recently developed a surface emitting laser, which emits light perpendicularly to its substrate, and which has a low threshold, and can be readily arrayed. A light emitting diode (LED) is also well known as a light emitting device whose fabrication cost is low and which can be readily implemented. The configuration of such a surface light-emitting-type device is similar to that of a light receiving device, such as a photodiode, which originally receives light at its surface. Therefore, those surface light emitting and receiving devices can be suitably combined, and are hence expected to be applied to an optical interconnection that optically connects boards, modules in a board, and [or] large scale integration (LSI) chips to each other.--



**VERSION WITH MARKINGS SHOWING CHANGES MADE TO CLAIMS**

1. **(Amended)** An optical waveguide comprising:

a partial cylindrical portion[, said partial cylindrical portion] having an elongated profile and being formed of a material transparent to [a] light propagating along said partial cylindrical portion; and

a plurality of end portions, each of said plurality of end portions having an approximately partial spherical profile smoothly joining said partial cylindrical portion, and being formed of a same material as a material of said partial cylindrical portion, whereby the light propagates along said partial cylindrical portion and said plurality of end portions and is totally reflected [reflects the light] at a boundary surface contouring said partial cylindrical portion and said plurality of end portions.

3. **(Amended)** An optical waveguide according to claim 1, wherein said partial cylindrical portion includes a crossing part having an approximately partial spherical profile smoothly joining a plurality of straight partial cylindrical portions [parts] of said partial cylindrical portion.

4. **(Amended)** An optical waveguide according to claim 1, further comprising a cladding portion[, said cladding portion being] in contact with at least a part of a core consisting of said partial cylindrical portion and said plurality of end portions,

said cladding portion [and] being formed of a material having a [whose] refractive index [is] lower than a refractive index of said core.

5. **(Amended)** An optical waveguide according to claim 4, wherein said cladding portion includes a flat substrate [which, is] in contact with at least a part of a flat boundary surface of said core.

6. **(Amended)** An optical waveguide according to claim 5, wherein said partial cylindrical portion, said plurality of end portions, and said substrate are formed such that light perpendicularly incident to said substrate through said plurality of end portions propagates along said partial cylindrical portion.

11. **(Amended)** An optical waveguide according to claim 10, wherein said substrate is [comprises] a flexible substrate.

12. **(Amended)** An optical interconnection device comprising:  
a waveguide including:

a partial cylindrical portion, which has an elongated profile, and is formed of a material transparent to [a] light propagating along said partial cylindrical portion; and

a plurality of end portions, each of said plurality of end portions having an approximately partial spherical profile smoothly joining said partial cylindrical portion, and being formed of a same material as a material of said partial cylindrical portion, whereby the light propagating along said partial cylindrical portion and said plurality of end portions is [totally] reflected at a boundary surface contouring said partial cylindrical portion and said plurality of end portions; and

a substrate with at least one of a light emitting device and a light receiving device disposed on said substrate, said plurality of end portions [of said waveguide] being positioned at a portion of said substrate corresponding to a position at which one of said light emitting device and said light [or] receiving device is disposed.

13. **(Amended)** An optical interconnection device according to claim 12, wherein said light emitting device includes [comprises] a surface emitting laser, which is composed of semiconductor crystal and includes an active layer sandwiched between a pair of reflective mirrors.

14. **(Amended)** An optical interconnection device according to claim 12, wherein said light emitting device includes [comprises] a light emitting diode (LED), which is comprised of a semiconductor crystal material and includes at least one of a pn junction and a pin junction.

16. **(Amended)** An optical interconnection device according to claim 12, wherein said light receiving device includes [comprises] a metal-semiconductor-metal (MSM) optical detector, which is composed of semiconductor crystal material.

17. **(Amended)** An optical interconnection device according to claim 12, wherein said substrate is [comprises] a semiconductor substrate on which an electronic circuit for driving and controlling said light emitting device is integrated, and said light emitting device is coupled with said semiconductor substrate.

18. **(Amended)** An optical interconnection device according to claim 12, wherein said substrate is [comprises] a semiconductor substrate on which an electronic circuit for amplifying and controlling said light receiving device is integrated, and said light receiving device is coupled with said semiconductor substrate.

19. **(Amended)** An optical interconnection device according to claim 12, wherein said waveguide optically connects a plurality of semiconductor circuit chips, each of said circuit chips being [which is] formed on said substrate.

20. **(Amended)** An optical interconnection device according to claim 12, wherein said waveguide optically connects a plurality of chip modules, wherein in each chip module [which] a plurality of [or] semiconductor circuit chips is [are] implemented.

21. **(Amended)** An optical interconnection device according to claim 12, wherein said waveguide forms [performs] an optical wiring on a circuit board in which a semiconductor circuit chip and a chip module are implemented in a mixed configuration.

22. **(Amended)** An optical interconnection device according to claim 12, wherein said waveguide optically connects circuit boards in which at least one of a semiconductor circuit chip and [and/or] a chip module is [are] implemented.

37. **(Amended)** An optical waveguide comprising:  
a first region having a straight partial [cylindrical] spherical shape [profile];  
and  
a second region having a curved partial spherical shape [profile], said second region being provided at an end of said first region.

39. **(Amended)** An optical interconnection device comprising:  
a light emitting device;  
a light receiving device; and  
an optical waveguide for optically connecting said light emitting device and said light receiving device, said optical waveguide including a first region having a straight, partial[, cylindrical] spherical shape [profile], and a second region having a

curved, partial spherical shape [profile], said second region being provided at an end of  
said first region.

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